Winter Cow Feeding Strategies

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Introduction

One of the largest costs for cow-calf producers is feed costs. Costs associated with feeding the producing beef cow represent over sixty percent of the total costs in a cow-calf production system and are the largest determinant of profitability for beef producers (Miller, et al., 2001). With recent increases in hay and grain prices, this percentage of total costs could be even higher.

The majority of feeding costs occur in the winter months when grazing is limited and pastures are not productive. Thus, improved winter feeding strategies can greatly impact profitability of the cow-calf producer. Despite this, producers have been slow to realize the benefits of improved winter feeding strategies because of low-cost grains and co-product feeds in past years. Low-cost commodities are simply not in the equation for feeding cows in 2013. Producers will need to investigate and implement improved winter feeding methods to maximize profitability in the coming years.

The historic drought of 2012 will have an effect on the cattle industry for many years to come. The situation presenting many cattlemen this year is unlike any they have dealt with in recent memory. While water is most likely the limiting factor in a drought, feed availability is a close second. Many cowherds are entering the winter in poorer condition due to limited forage availability in pastures this summer. This combined with low winter feed supplies could lead to more cow liquidation or poor calving and re-breeding results in 2013.

Providing a balanced, least-cost ration to the cowherd is ultimately the best management strategy. A balanced, least-cost ration can be formulated from a number of different feedstuffs. Product availability and transportation costs can result in numerous different least-cost rations within a region. Not all feedstuffs are ideal; balancing the pros and cons of feedstuffs is dependent on individual operations. An improved winter feeding strategy can result in numerous different systems, but at the end of the day an improved winter feeding system should result in lowering feed costs and an increase in opportunity for profits.

Feeding Hay

The traditional method of winter feeding the producing cow has been feeding hay. Feeding hay is often the preferred method of winter feeding due to ease of handling and simplicity. Arguably the most common winter feeding strategy in the Midwest is to offer unlimited access to hay. Unfortunately, it is one of the most expensive systems.

Limit-Feeding Hay

Hay waste is responsible for much of the increased costs associated with feeding hay ad libitum. Thus, in effort to reduce costs of feeding hay, waste must be reduced. University of Illinois' Orr Beef Research Center has hosted numerous trials looking at limit-feeding hay as a method of reducing waste and thus, an economical alternative to feeding unlimited access hay. A summary of 3 different experiments is discussed in the following paragraphs.

The following is a list of the experiments to be summarized. Experiment 1 (Miller et al., 2007) evaluated different time restrictions to hay (3h, 6h, 9h) against unlimited access (24h) in late-gestation cows. Experiment 2 (Cunningham et al., 2003) looked at time restricted access of hay (4h, 8h, 24h) in lactating cows. In Experiment 3 (Cunningham et al. 2003) researchers assessed feeding lactating cows ground hay at 80, 90, and 100% NRC requirement when Rumensin® was fed at 200mg/hd/d.

Restricting time of access to hay is a method of limit-feeding hay. This method is especially appealing to average or smaller sized producers that do not have the equipment or facilities to limit-feed hay by grinding and feeding in bunks. Restricting time of access has proven to decrease hay waste. In Experiment 1 (Miller et al., 2007), hay waste decreased linearly as time of access decreased. In Experiment 2 (Cunningham et al., 2003) hay waste was decreased numerically with restricted access, but was not found significant. Restricting time of access also decreases hay disappearance and hay intake. By decreasing intake do we sacrifice performance? In Experiment 1, which utilized late-gestating cows, all treatments gained weight. However, in Experiment 2, which used lactating cows, cows lost weight across all treatments. Thus, it is important to consider stage of production, hay quality, as well

as environmental factors when choosing to limit-feed hay. Hay quality and nutrient analysis is shown in Table 1.

Another method of limit-feeding hay is to feed ground hay in bunks. Experiment 3 (Cunningham et al., 2003) looked at feeding cows at 80%, 90%, and 100% of NRC requirement with Rumensin added at 200mg/hd/d. Cows in all treatments experienced a decrease in weight, but these differences were not statistically different. The fact that cows at 100% requirement lost weight suggests that requirements were under-estimated for this set of cows or feed analysis did not accurately represent the forage. This trial illustrates that limit-feeding hay with Rumensin can allow a producer to feed cows at 80% or 90% with similar

Table 1. Hay analysis for experiments [a](Miller et al., 2007) [b](Cunningham et al., 2003)

Item	Dry Matter Basis		
	Exp. 1[a]	Exp. 2[b]	Exp. 3[b]
Crude Protein, %	17.57	19.56	15.97
Acid Detergent Fiber, %	35.19	32.85	41.92
Neutral Detergent Fiber, %	45.00	44.11	50.03
TDN, %	62.25	63.79	57.86
Net energy of lactation, Mgcal/kg	1.34	1.41	1.17
Net energy of gain, Mgcal/kg	0.81	0.85	0.68
Net energy of maint., Mgcal/kg	1.39	1.43	1.23
Relative Feed Value	127	134	105
Calcium, %	1.08	1.12	1.18
Phosphorous, %	0.27	0.23	0.29
Magnesium, %	0.18	0.20	0.23
Potassium, %	2.17	2.00	1.63
Sulfur, %	0.23	0.23	0.17

Table 2. Effect of restricting time of access to hay on cow performance, hay disappearance, and manure production. (Exp.1, Miller et al., 2007)

Item	Treatments				P-value	
	3 hr	6 hr	9 hr	24 hr	Linear	Quad
Initial Wt., lb.	1254	1239	1243	1256	.81	.64
Final Wt., lb.	1373	1399	1434	1463	.10	.45
Wt. Change, lb.	119	160	191	207	<.01	.03
Hay disappearance, lb DM/hd/d[a]	17.6	24.4	29.2	34.1	<.01	<.01
Manure production, lb DM/hd/d[b]	11.6	14.9	19.6	22.7	<.01	.07
Fecal output, lb DM/hd/d[c]	5.9	9.2	10.3	9.2	<.01	<.01
Hay waste, lb DM/hd/d[d]	5.9	5.7	9.2	13.4	<.01	.70
Hay waste, %[e]	33.3	23.2	31.5	39.5	.21	.49
Intake, lb DM/hd/d	11.7	18.7	20.0	20.7	.03	.03
Digestibility, %	49.4	50.5	48.6	53.4	.48	.76

[a] Calculated as amount offered minus refusals
[b] Physical collection of manure from pens including hay waste
[c] Calculated from chromium concentration in feces
[d] Calculated by subtracting fecal output from manure production
[e] Calculated by dividing hay waste amount by hay disappearance

Table 3. Effect of time restriction to hay on cow and calf performance, hay disappearance, and manure production (Exp.2, Cunningham et al., 2003)

Item	Treatments				P-value	
	4 hr	8 hr	24 hr	SE	Linear	Quad
Initial BW, lb.	1370	1318	1381	30.6	.47	.21
Final BW, lb.	1245	1257	1337	33.3	.06	.89
BW Change, lb.	-125	-61	-44	24.6	.08	.17
Initial calf BW, lb.[a]	99	98	100	2.3	.64	.62
Final calf BW, lb.	255	251	258	11.0	.72	.75
Calf ADG, lb/d.	2.2	2.2	2.2	.08	.77	.75
Milk Production, lb. [b]	9.9	9.9	10.0	.53	.70	.85
Hay disappearance, lb DM/hd/d	22.4	32.1	35.6	1.36	<.01	<.01
Manure production, lb DM/hd/d[c]	13.9	18.7	22.9	3.30	<.01	.08
Fecal output, lb DM/hd/d[d]	11.8	14.7	16.5	1.65	.13	.41
Hay waste, lb DM/hd/d[e]	2.2	4.0	6.4	2.3	.27	.77
Hay waste, %[f]	9.8	13.0	18.1	11.0	.43	.87

[a] Calf Birth BW was used for initial BW
[b] Milk Production estimate was obtained using 12-h weigh-suckle-weigh technique
[c] Physical collection of manure from pens, includes hay waste
[d] Calculated from chromium concentration in feces
[e] Calculated by subtracting fecal output from manure production
[f] Calculated by dividing hay waste amount by hay disappearance

performance to cows fed 100% of their requirement.

Research shows that limit-feeding hay can be an effective strategy to decrease over-consumption of hay during stages of production that correspond with lower requirements, can reduce hay disappearance and hay waste when feeding large round bales, and can decrease manure production. Decreasing over-consumption, reducing hay waste, and decreasing manure production can directly return dollars back to a producer's pocket. It is important to realize hay quality, stage of production, mature cow weights, and environmental factors all play a role in determining if limit-feeding-hay is a viable money-saving feeding strategy.

Table 4. Effect of feeding ground hay at restricted levels on cow and calf performance, hay disappearance, and manure production (Exp.4,Cunningham et al., 2003)

	Treatments[a]			P-value		
Item	80%	90%	100%	SE	Linear	Quad
Initial BW, lb.	1334	1366	1354	35.6	.71	.62
Final BW, lb.	1270	1306	1308	31.8	.06	.89
BW Change, lb.	-64	-60	-46	15.2	.40	.78
Initial calf BW, lb.[b]	91	89	93	2.4	.68	.32
Final calf BW, lb.	213	210	216	14.3	.89	.79
Calf ADG, lb/d.	2.0	2.0	2.0	.09	.79	.97
Hay disappearance, lb DM/hd/d	25.5	27.7	30.3	.20	<.01	.35
Manure production,lb DM/hd/d[c]	9.0	9.9	11.0	1.49	.36	.94

[a] Rumensin® was included in all diets at 200mg/hd/d
[b] Calf Birth BW was used for initial BW
[c] Physical collection of manure from pens, includes hay waste

Bale Feeder Design

As previously stated, feeding hay ad libitum is the most popular winter feeding strategy in the Midwest. In most cases, hay is packaged into large round bales and fed in some type of feeder. Many different designs claim to reduce hay waste, thus prompting research in this area.

Buskirk et al. (2003) evaluated large round bale feeder design and the subsequent effect of hay utilization and hay waste. The study compared four different hay feeder designs: cone, ring, trailer, and cradle. All feeder designs resulted in similar cow intakes. However, the amount of hay wasted was different between designs. Hay waste was least to greatest in this order: cone, ring, trailer, and then cradle. The type of hay offered in this trial was second cutting alfalfa and orchard grass. The hay tested approximately 13% CP, 53% NDF, 35% ADF on a dry matter basis. This trial shows that feeder design does impact hay waste.

Table 5. Effect of feeder type on hay waste and cow intake (Buskirk et al., 2003)

	Feeder Type				
Item	Cone	Ring	Trailer	Cradle	SEM
Initial cow weight, lb.	1383	1389	1390	1385	9.5
Hay disappearance, lb DM/hd/d	26.4[x]	26.6[x]	30.5[y]	28.3[xy]	0.9
Hay waste, lb DM/hd/d	0.9[x]	1.5[y]	3.5[z]	4.2[z]	0.22
Hay waste, %[a]	3.5[x]	6.1[x]	11.4[y]	14.6[y]	0.8
Hay intake, lb DM/hd/d	25.3	25.1	27.0	24.2	0.9
Intake/cow BW, %	1.8	1.8	2.0	1.8	0.1

a Hay waste as a percentage of hay disappearance
xyz Within a row, least square means without a common superscript letter differ (P< .05)

A field trial conducted by Oklahoma State University and The Noble Foundation looked at hay feeder design and associated wastes. Four different feeder designs were evaluated: cone, sheet, ring, and poly. Hay waste for the feeders as listed in parenthesis: cone (5.3%), sheet (13.0%), ring (20.5%), and poly (21.0%). Costs were analyzed as well. They assumed a hay price of $116/ton or $70/bale. Assuming a producer with 30 cows will feed 180 bales in a season, the costs associated with hay waste were $667 (cone), $1,638 (sheet), $2,583 (ring), and $2,646 (poly) per season. It is easy to see that improved feeder designs like the cone-shaped hay feeder can save producers money by reducing hay waste.

Table 6. Effect of feeder design on hay waste and cost (Wells, Lalman)

	Feeder Type			
Item	Cone	Sheet	Ring	Poly
Waste, % bale wt.	5.3[x]	13.0[y]	20.5[z]	21.0[z]
Total waste, lb/bale	63.6[x]	156[y]	246[z]	252[z]
Cost of waste/bale, $*	3.71[x]	9.10[x]	14.35[y]	14.70[y]
Cost of wasted hay/month, $*	111.30	273.00	430.50	441.00
Cost of wasted hay/season, $*	66.7.80	1638.00	2583.00	2646.00

xyz Within a row, least square means without a common superscript letter differ (P< .05)
*Assuming $70 per 1,200 bale, feeding 180 bales per season

Cornstalk Feeding

In the Midwest, high prices received for corn and soybean commodities have demanded a shift in acres away from hay and pasture to row crop production. In a 2012, Illinois planted an additional 1,800,000 acres of corn and Iowa an additional 2,500,000 acres of corn when compared to 2001 (NASS, 2012). Obviously, there is an abundant supply of cornstalks in the Midwest. Can cornstalks be used to effectively feed cows?

Grazing Cornstalks

Two methods of utilizing cornstalks as cow feed are grazing or harvesting as baled forage. Grazing cornstalks is the preferred method of harvest because it is lower cost. Cost of fencing and making water available is always cheaper per acre than costs associated with feeding baled cornstalks (machinery, fuel, storage, manure removal, etc.).

Cornstalks alone can provide adequate nutrition for mid and late gestation females (Warner et al., 2011). Cows selectively graze cornstalks. They harvest the most palatable components first and the least palatable last. For the most part, cows select the components in this order: remaining corn grain, husks, leaves, and then stalks. In the case of cornstalks, palatability also corresponds with nutrition. The portions of the plant selected first are more nutritious than those selected later. This allows cows to meet requirements if enough grain, husks, and leaves are present. Higher stocking rates and poor weather conditions can result in less available grain, husks, and leaves. Grazing cornstalks without supplementation can be a low-cost method of winter feeding, however stocking rate and weather conditions play a role in the success of this strategy.

A field trial conducted at the University of Illinois' Dudley Smith Research Farm in 2008 demonstrated how grazing cornstalks supplemented with DDGS could be used as a low-cost feeding strategy. The trial compared strip-grazing management of cornstalks and different stocking rates. Similar results were seen across treatments as all cows gained weight and BCS. In this trial in which cows were supplemented and strip grazed, cornstalks served as a low-cost method of wintering cows. At the time of the trial DDGS was valued at $100/ton and total costs averaged $0.49/hd/d. If DDGS is valued at $275/ton, total costs average $0.84/hd/d. It is important to note that grazing cornstalks is dependent on fence and water availability. If a weather event results in heavy snowfall or ice, cornstalk grazing is likely not possible. In this situation cows will need to be offered baled forage. Nevertheless, supplementing cows grazing cornstalks can be far cheaper than drylot rations, further illustrating that cornstalks can be utilized as a low-cost alternative winter feeding strategy.

Table 7. Effects of strip grazing cornstalks and stocking rate on cow performance (Shike, Faulkner, Ballard, 2008)

Item	1 / acre (2 wk)	1.5 / acre (2 wk)	1.5 / acre (1 wk)
Initial BW, lbs	1260	1276	1272
Final BW, lbs	1343	1340	1318
BW Change, lbs	83	63	46
Initial BCS	5.4	5.4	5.3
Final BCS	5.8	5.7	5.8
BCS Change	0.4	0.3	0.4

Table 8. Effects of strip grazing cornstalks and stocking rate on costs (Shike, Faulkner, Ballard, 2008)

Item	1 / acre (2 wk)	1.5 / acre (2 wk)	1.5 / acre (1 wk)
Corn stalks ($10/acre), $/hd/d	$0.24	$0.16	$0.16
DDGS ($275/ ton @ 4 lbs/hd/d)	$0.55	$0.55	$0.55
DDGS feeding labor[a] , $/hd/d (1.5 hrs for all 192 hd)	$0.09	$0.09	$0.09
Fence moving labor[a] , $/hd/d (20 minutes – 2x or 5x)	$0.01	$0.01	$0.02
Total cost, $/hd/d	$0.89	$0.81	$0.82

[a] Labor @ 12/hr

Feeding Baled Cornstalks

In many cases corn fields are not fenced and water is not available. Cornstalks can be harvested from the field by baling. Baling cornstalks can provide an alternative to grazing, but additional costs exist. Additional costs associated with baling cornstalks include machinery, fuel, labor, and nutrient removal costs. It is important to realize and apply these costs to the cornstalk bale to accurately determine the cost of the feedstuff. Even with these additional costs, many times baling cornstalks still is more economical than purchasing other feeds.

Baled cornstalks are normally 3-5% CP and 45-54% TDN. It is important to sample and test for nutrient analysis as variability is high. Supplementation is necessary to balance rations using baled cornstalks. Even with supplementation costs, feeding baled cornstalks can be an economic alternative to feeding hay.

Table 9. Effect of winter feeding strategy on spring-calving beef cows (Braungardt et al., 2010)

Item	Treatments[1]				SE	Contrast		
	AdLib Res	TMR	LowRes TMR	AdLib Hay		1 vs. 2,3	2 vs. 3	1,2,3 vs. 4
Bale disappearance,[2] lb/d	12.9	-	-	32.3	-	-	-	-
DM disappearance,[3] lb/d	27.2	28.4	26.4	32.3	-	-	-	-
Initial BW, lb.	1408	1430	1470	1469	56.1	.17	.27	.77
Final BW, lb.	1370	1383	1445	1361	54.7	.14	.08	.18
BW Change, lb.	-38	-47	-25	-108	28.1	.89	.23	.04
Milk Production, lb/d	26.6	24.6	22.6	22.2	1.52	.10	.35	.12
Calf ADG, lb/d	2.6	2.5	2.6	2.6	.12	.37	.33	.62
First-service AI, %	55	50	47	36	6.7	.48	.81	.09

1 Treatments: 1) AdlibRes = 14.3 lbs. DDGS (ADM, Peoria, IL), free-choice corn residue bale; 2)TMR = 14.3 DDGS, 14.1 lbs. corn residue; 3) LowResTMR = 16.5 lbs. DDGS, 9.9 lbs. corn residue; 4) AdLibHay = free-choice alfalfa mixed hay.
2 Bale disappearance represents corn residue bale for treatment 1 and alfalfa mixed hay for treatment 4.
3 DM disappearance of coproduct and corn residue bale or alfalfa mixed hay, depending on treatment.
4 24hr milk production determined using the weigh-suckle-weigh technique at 53±14.9 postpartum.

Corn co-products such as CGF and DDGS work well for supplementing cornstalks. Shike et al. (2009) concluded that cornstalks supplemented with high levels of co-products (up to 75% of the diet) could effectively maintain cow weight, milk production, and reproduction in lactating mature cows. Economic feasibility of wintering lactating cows on cornstalks and co-products would greatly depend on price and availability of co-products.

Limiting waste is an issue with feeding cornstalk bales. Many times strategies to limit waste include bale processing and feeding a Total Mixed Ration (TMR). Bale processing and use of a TMR feeding system adds equipment costs to an operation. Braungardt et al. (2010) compared feeding strategy on feed costs for varying herd sizes. Hand feeding and feeding with equipment was evaluated. Equipment assumed for treatment 1, where cornstalks where fed ad libitum in feeders, was a feeder wagon. In treatment 2 and 3, where cornstalks were ground and fed in a TMR in a bunk, a grinder-TMR mixer (vertical mixer) was used. Cow performance is shown in Table 9 and feed costs are shown in table 10.

Table 10. Effect of winter feeding strategy on feed costs for varying herd sizes (Braungardt et al., 2010)

Item	Treatments[1]			
	AdLib Res	TMR	LowRes TMR	AdLib Hay
Feed Cost,[2] $/cow per day	1.40	1.45	1.48	2.50
Hand Feeding,[2,3,4,5] $/cow/d				
50 cows	2.19	-	-	-
100 cows	2.19	-	-	-
Tractor Feeding,[2,3,4,5] $/cow/d				
50 cows	3.58	3.90	3.93	3.21
100 cows	2.73	2.91	2.94	3.21
150 cows	2.44	2.58	2.61	3.21
200 cows	2.30	2.42	2.45	3.21
250 cows	2.21	2.32	2.35	3.21
300 cows	2.15	2.25	2.28	3.21

[1] Treatments: 1) AdlibRes = 14.3 lbs. DDGS (ADM, Peoria, IL), free-choice corn residue bale; 2)TMR = 14.3 DDGS, 14.1 lbs. corn residue; 3) LowResTMR = 16.5 lbs. DDGS, 9.9 lbs. corn residue; 4) AdLibHay = free-choice alfalfa mixed hay.
[2] Feed Prices: DDGS, $124/ton; alfalfa mixed hay, $131/ton; corn residue, $55/ton
[3] Hand feeding calculated for treatment 1 only at 1h/50 cows at $15.95/h.
[4] Tractor cost = $58.95/h (overhead, $23.10; fule, $19.90; labor, $15.95).
[5] Bale feeding estimated at 10 min/bale fed (2.4 corn residue bales/d per 50 animals, 3.6 alfalfa mix hay bales/d per 50 animals) using a tractor.
[6] Annual ownership cost of the feed wagon (treatment 1) was $4,009 and of the grinder-TMR (treatment 2&3) mixer was $6,014.

Utilizing cornstalks is a cost-saving advantage to high priced hay. Cornstalks supplemented with co-products can be utilized by both large and small producers. Smaller producers with less than 50 head need to be willing to bucket feed the co-product, because equipment costs would not be justifiable at this number of cows. If they are not willing to bucket feed, then hay may be the cheapest strategy. For producers running over 100 cows, the added cost of equipment is easily justified with the feed savings of grinding and feeding a TMR. Size of operation and labor situation does have an impact on the economic feasibility of winter feeding strategies.

Corn Silage

Drought conditions hurt corn yields and in some cases caused total failure to produce grain. In effort to salvage failed crops and fill the place of low hay production in 2012, many producers made corn silage. Corn silage has been used for cattle feed for years, but in the recent biofuels era corn silage use has diminished. Producers that have not fed corn silage for years or even at all will feed corn silage this year.

Feeding corn silage instead of hay requires a few mental adjustments. The moisture content is drastically different. Thus 100 tons of corn silage is not equivalent to 100 tons of corn silage. Corn silage is normally around 35% dry matter vs. hay which is usually in the 85% dry matter range. It is important to convert all feeds to dry tons to accurately compare inventory and price as well. Cowboy math tells us that 100 tons of 35% DM corn silage is 35 dry tons of feed, whereas 100 tons of 85% DM hay is 85 dry tons. Moisture content of corn silage is an adjustment for those that have not fed wet feeds in recent years.

Testing for nitrates and obtaining a nutrient analysis is extremely important when dealing with drought-stressed corn silage. Nitrate levels and nutrient analysis will ultimately determine feeding strategies for corn silage. Elevated nitrate levels will result lower inclusion rates of corn silage. Large amounts of variation in nutrient analysis exist in the corn silage from 2012. Testing corn silage is a no-brainer.

Corn silage, even if drought-stressed, would be good quality forage. Cows consume good quality forage at 2.5% of body weight. This means a 1400 lb. cow will consume 35 lbs. DM or 100 lbs. as-is of corn silage. Even assuming the lower TDN of drought-stressed corn silage, energy requirements would be surpassed at this intake. As a result, limit-feeding corn silage and supplementing protein would best match cow requirements. Using poor quality forages, corn silage and protein supplementation if need is a proven winter feeding strategy. Feeding corn silage ad libitum will in most cases result in overfeeding.

Conclusions

Winter feeding strategies have the capability to greatly impact profitability in cow herds. Various different feedstuffs can be used to meet cow requirements, but certain feeds will match operation size and labor better than others. Managing feed waste, incorporating low-cost, alternative feeds, and utilizing balanced, least-cost rations will result in lower feed costs. Lowering winter feed costs is vital to offsetting increasing input costs and thus can directly increase profitability.

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